

Adaptive Lessons Featuring Virtual Reality Experiences that Simulate On-the-Job Food Safety Learning for Artisan Dairy Processors

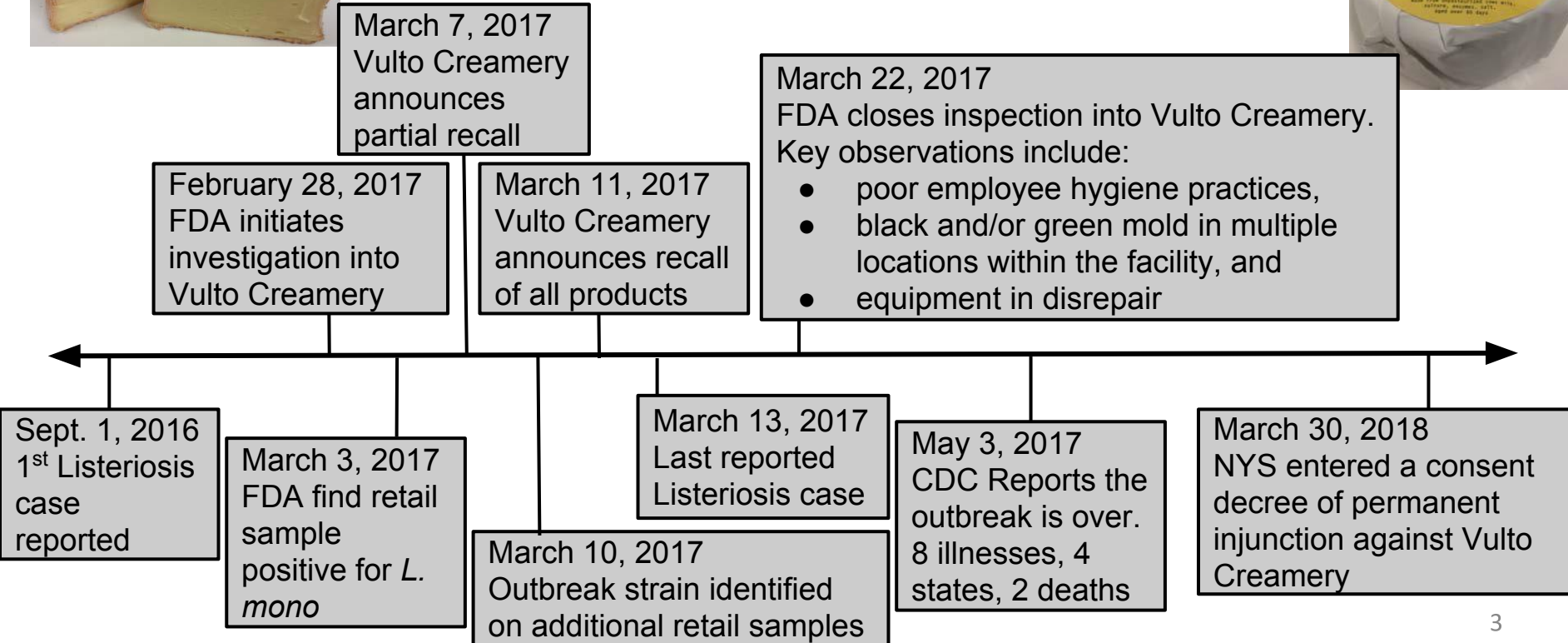
By: Stephanie Maggio, Julie Yamamoto,
Nathaniel Powers & Clinton Stevenson

Connecting with Students





Vulto Creamery Outbreak



Connecting with Students is Imperative For Food Safety Training



Food Safety
Modernization Act
(FSMA) of 2011



Environmental
monitoring is now
a requirement



Impact on artisan
dairy community

Small Business Hurdles to an Effective Food Safety System

1. Lack of food safety understanding ^{1, 2, 3}
 - a. i.e. understanding of terminology, cleaning & sanitation procedures, risks, etc.
2. Lack of Prerequisite Programs ²
3. Lack of resource feasibility ^{2, 3}
 - a. i.e. time, money, employees
4. Lack of employee motivation ²
5. Inadequate physical condition of the facility ^{2, 3}
6. Lack of availability of relevant training ⁴

Top Sanitation Concerns of Food Processors

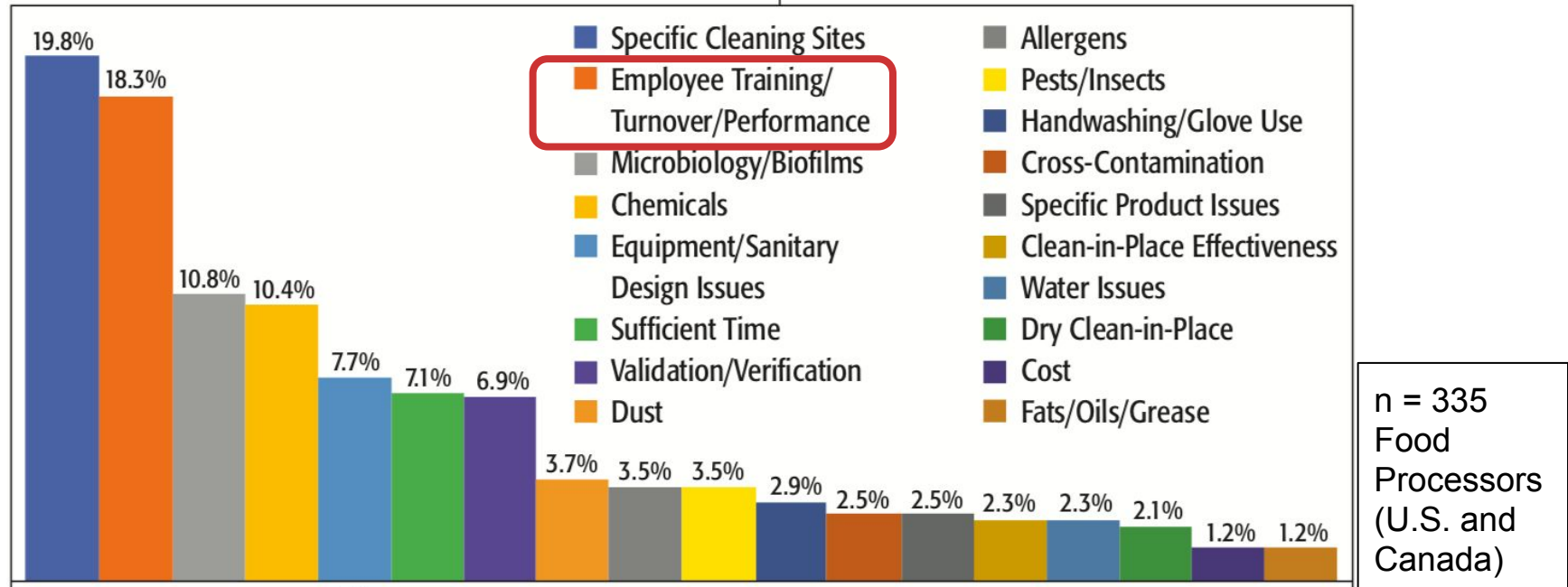


Figure 1. Top Sanitation Problem Areas

Current Food Safety Training

- Majority face-to-face training
- Majority designed with no needs analysis
- Majority designed with no learning theory consideration



Social Constructivism Paradigm

Learning occurs on two levels



Socially



In the Mind

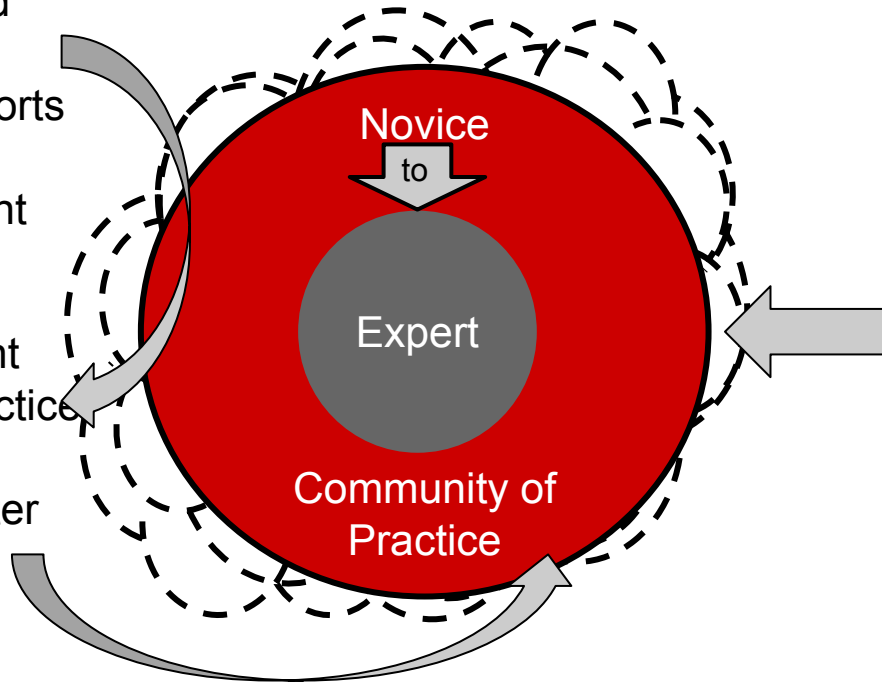
Situated Learning Theory

- Learning in the context of where the material will be applied
- Has a social component
 - “Legitimate peripheral participation”

Legitimate Peripheral Participation

Novice learner's initial and peripheral engagement is legitimized and thus supports the development of early practices and their inherent skills

With extended engagement with the 'community of practice' the learner progressively develops or acquires greater and more sophisticated participative skills.



The 'community of practice' boundary is a dynamic and flexible entity, allowing ease of access to socially constructed practices and engagement

Computer-Based Simulation Training

When compared to a control group, **training that includes simulation has a greater effect on the following:** (n = 65)

- Post-training self-efficacy ~20% greater
- Declarative knowledge ~11% greater
- Procedural knowledge ~14% greater
- Retention ~9% greater

Adaptive Learning: Data Analytics

Lesson Summary



The percentage of your custom states (e.g. adaptive feedback for a misconception) that have been triggered and seen by at least one student.

A low value (less than 80%) suggests that your states are not effectively targeting students' responses.

Online in the Last Hour

0

Median Time Spent

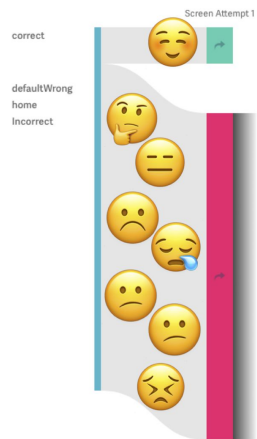
0 ^{HR} 30 ^M

Student Traffic (Unique)



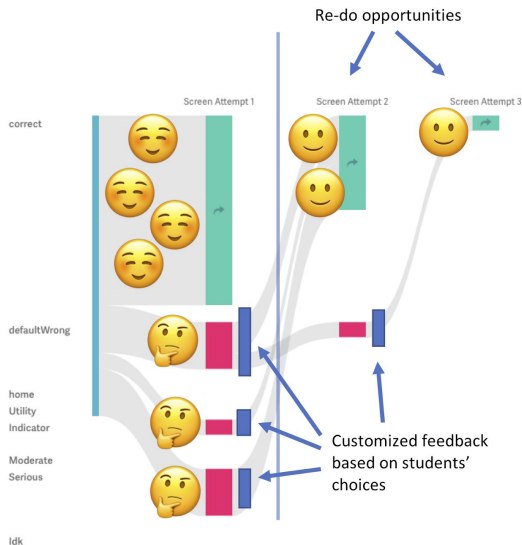
Adaptive Learning: Data Analytics

HOW TRADITIONAL LEARNING OFTEN HAPPENS:

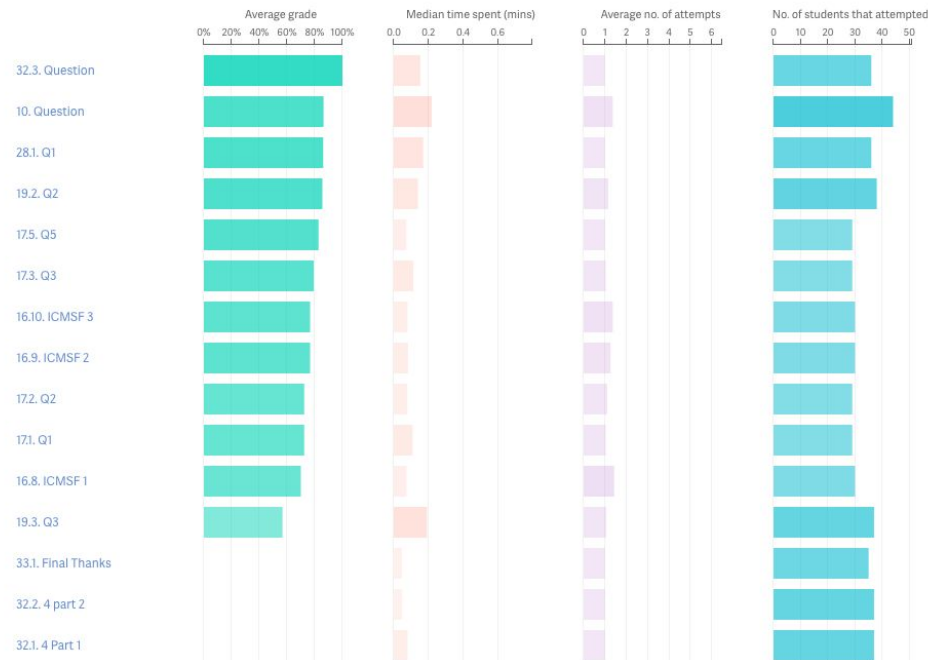


- One chance: Either correct or incorrect result.
- Hope that students learn from their mistakes/misconceptions

HOW ADAPTIVE LEARNING HAPPENS:



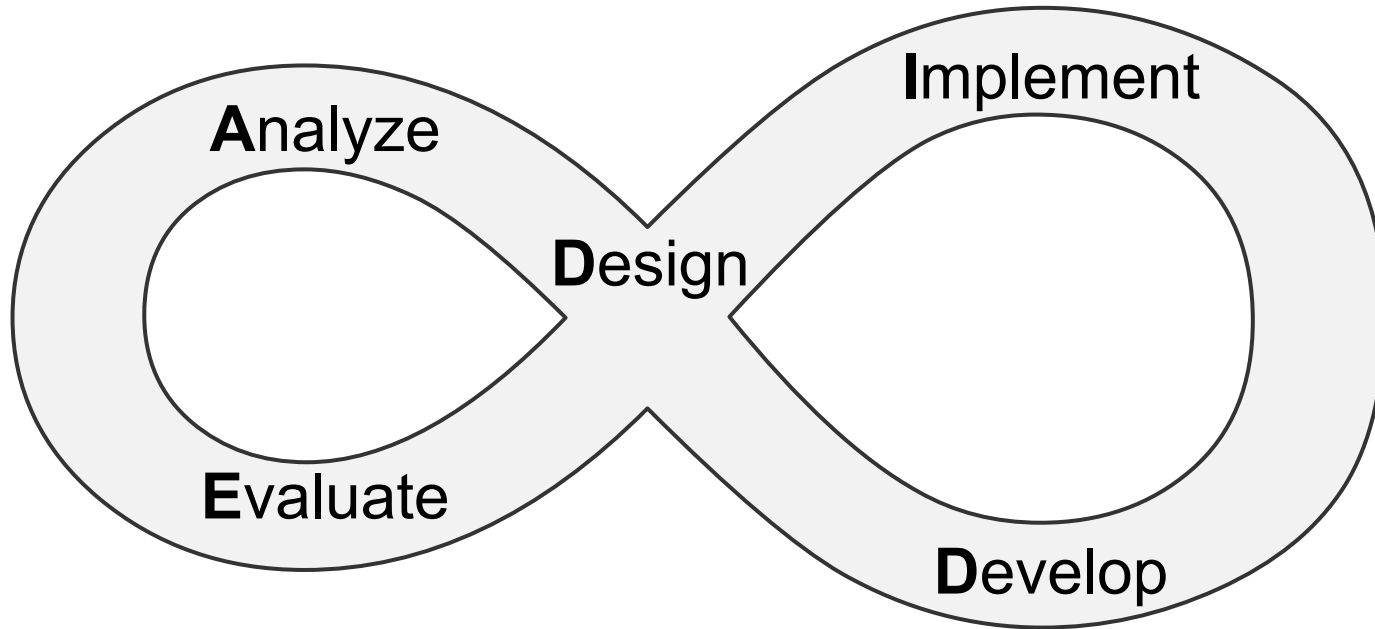
Question Explorer Click on a question to view more analytics



Hypothesis

Adaptive learning featuring virtual reality experiences that simulate on-the-job training is an effective teaching strategy for improving the food safety knowledge, attitudes, norms, personal agency, intentions and behaviors of NC small dairy processors.

Instructional Design Process



Needs Analysis: Purpose

1. Identify the demographics of North Carolina Artisan Dairy Processors.
2. Use the Integrated Behavior Model (IBM) to assess which components of behavior predict the Artisan's decision to perform safe food handling behaviors.

Needs Analysis: Methods



Identified Audience ($n=49$)



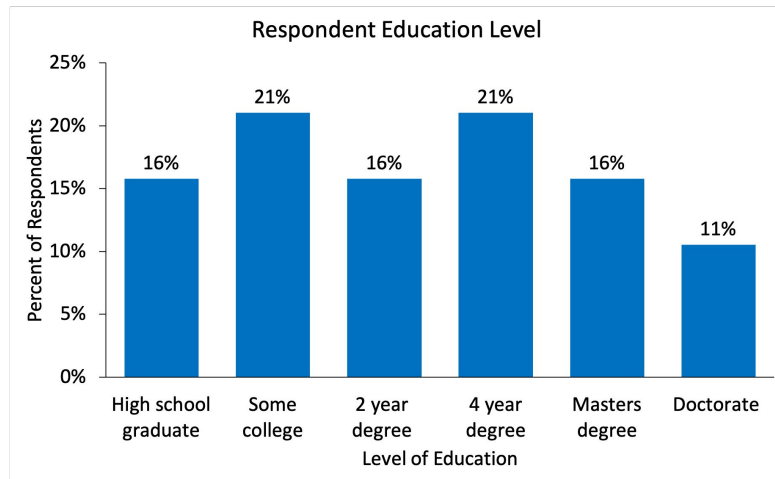
Face-to-face Interviews ($n=7$)



Online Survey ($n=21$)

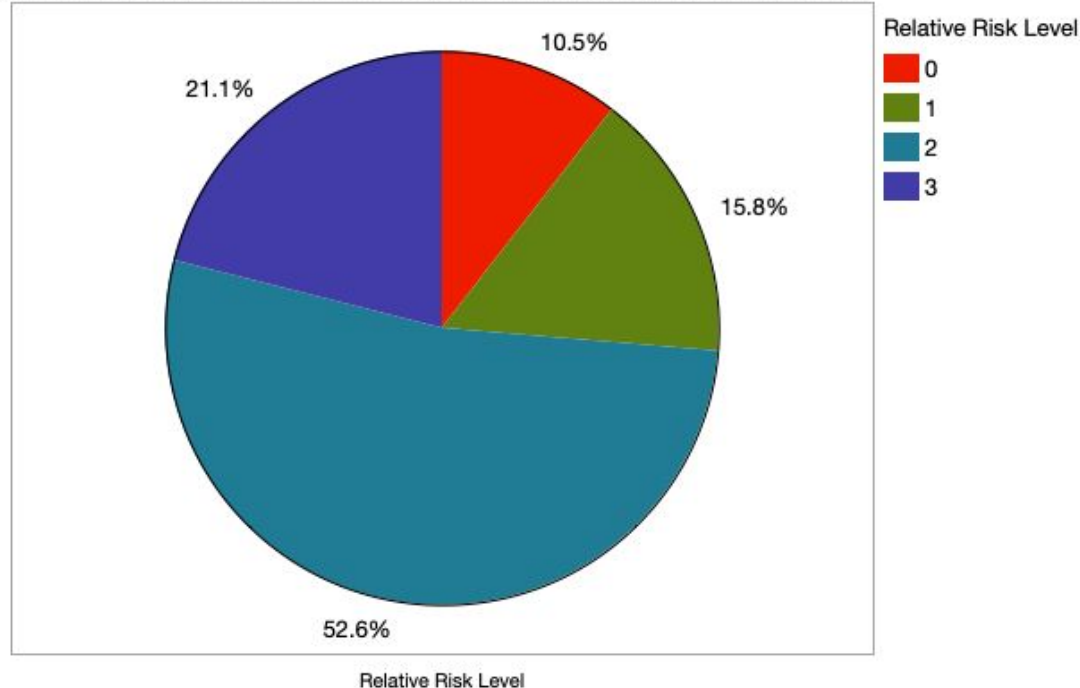
Needs Analysis: Demographics

Key Characteristics of NC Artisan Dairy Processors ($n=19$)



Needs Analysis: Relative Risk

Number of High-Risk Activities Reported by Respondents

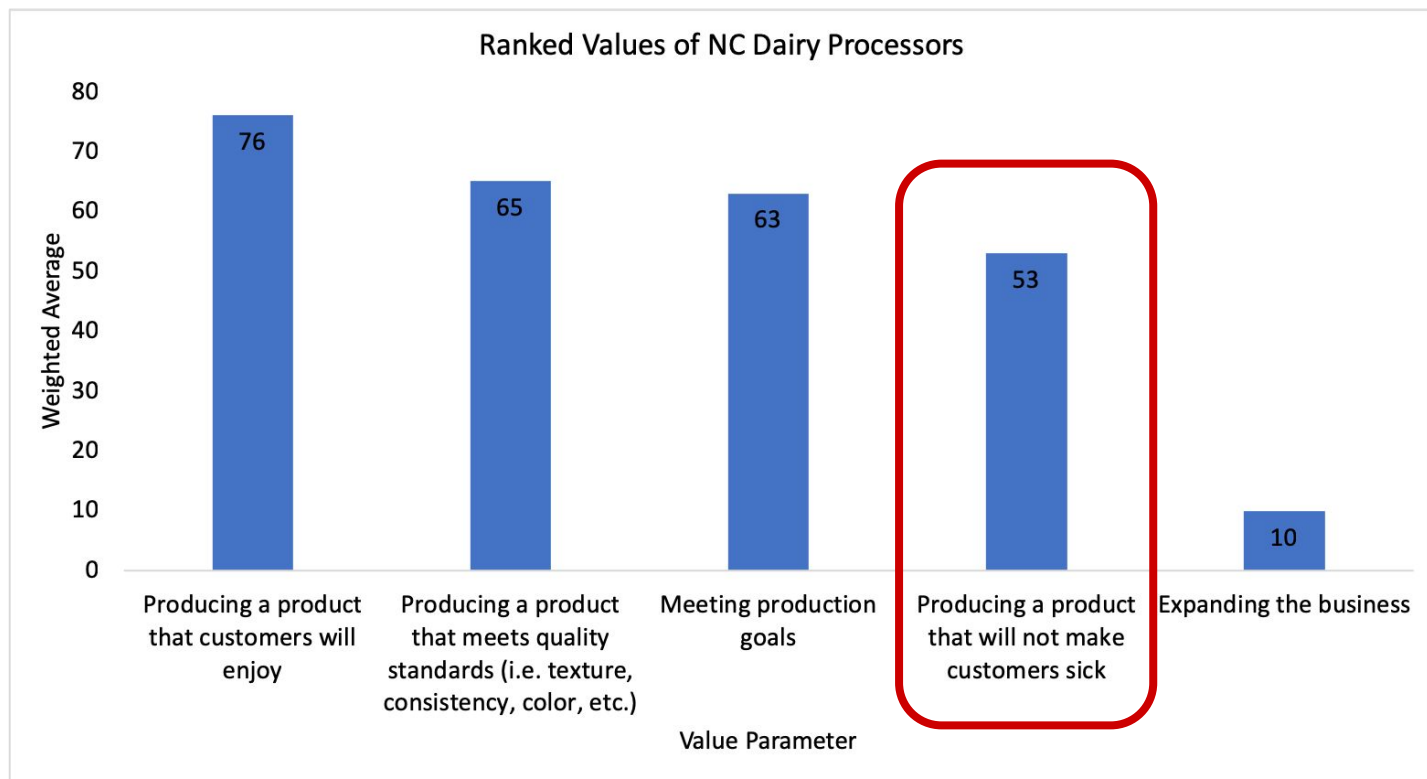


Risk Level

Determination:

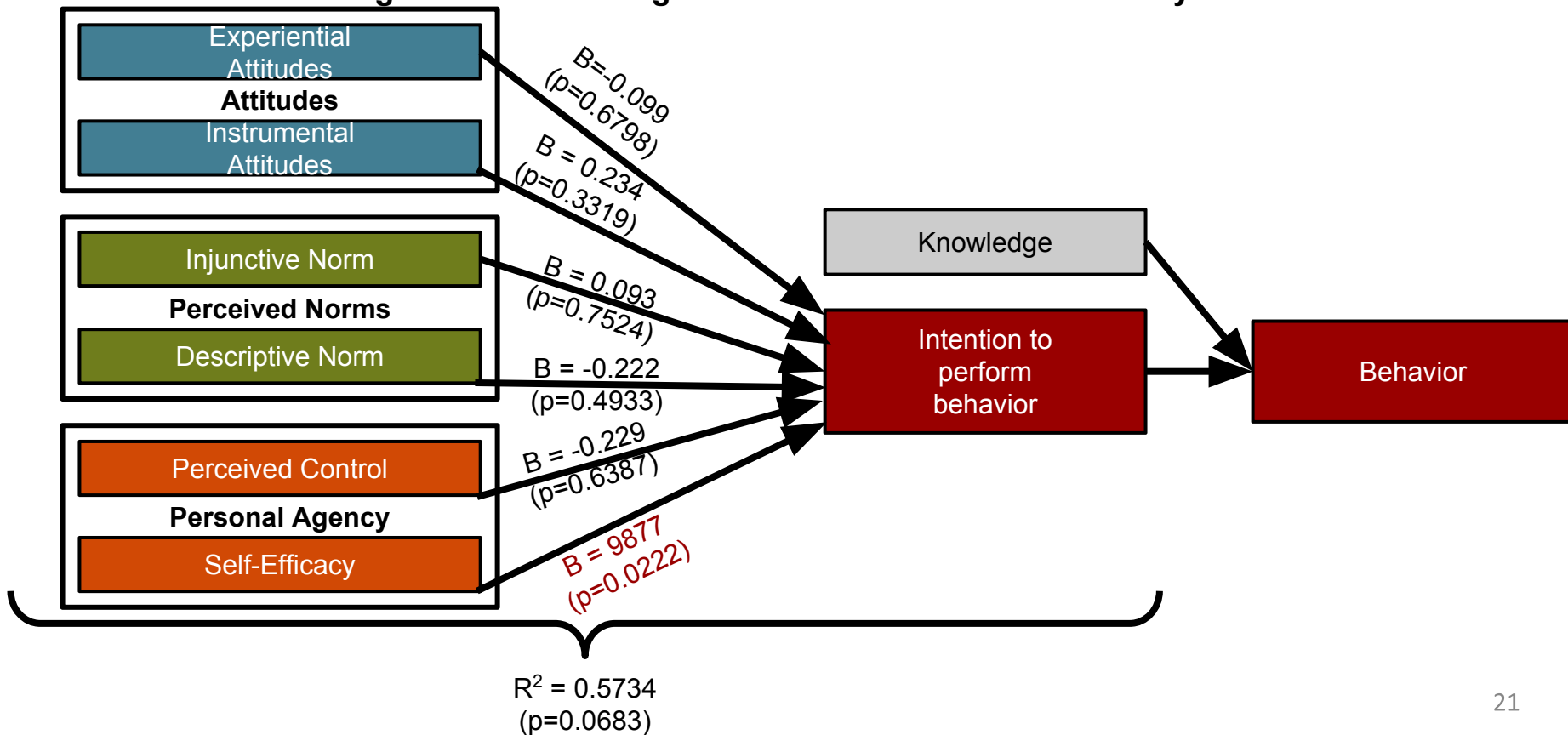
- 1pt for producing raw products
- 1pt for offering tours
- 1pt for farm on site

Needs Analysis: Target Audience Values



Needs Analysis: Behavior Predictors

Linear Regression Predicting Intentions to Perform Food Safety Behaviors



Needs Analysis Conclusions

- 8th grade reading level
- Social aspect
- Help users identify high-risk
- Ability to “practice” new skills and build self-efficacy

Training Design

- Case study
- Adaptive learning
 - Remedial pathways
 - Personal feedback
 - Choose your own path
- Virtual situated learning
 - Observe behavior being performed
 - “Perform” behavior

Adaptive Learning - Remedial Pathways

In the Cheesy Wheel case, the first routine sample that came back positive was in Zone 1, on the cheese form used to form blocks of sharp cheddar cheese.



Use that information to locate the correct cell in the FDA table to determine which corrective actions you should take. Move the pin to the correct table cell below:

Corrective Actions when <i>Listeria</i> species is found in an environmental sample			
PINS		Food Contact Surfaces (Zone 1)	Non-Food Contact Surfaces (Zones 2 - 4)
	Routine Sampling Positive #1	- Intensified cleaning and sanitizing in the area where positive occurred - Retest positive site and perform intensified sampling and testing during next production run (at least 3 hours into production) - Conduct comprehensive investigation - root cause analysis	- Clean and sanitize area where positive occurred - Retest positive site and perform intensified sampling and testing during next production cycle
	Follow Up Sampling Positive #2	- Intensified cleaning and sanitizing for 3 consecutive days (including disassembly of equipment) - Intensified sampling and testing for 3 consecutive days - Hold and test product for <i>Listeria monocytogenes</i> from the finished product for 3 consecutive days. Hold for second and third of 3 consecutive days	Intensified cleaning and sanitizing for 3 consecutive days

That's still incorrect. It looks like you could use a little more information on how to use the FDA table. Click Next for more info.



HISTORY



TRY AGAIN

Adaptive Learning - Remedial Pathways

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		investigation - root cause analysis	
	Follow Up Sampling Positive #2	- Intensified cleaning and sanitizing for 3 consecutive days (including disassembly of equipment) - Intensified sampling and testing for 3 consecutive days - Hold and test product for <i>Listeria monocytogenes</i> from the first, second and third of 3 consecutive days.	Intensified cleaning and sanitizing for 3 consecutive days (including disassembly of equipment)

That's still incorrect. It looks like you could use a little more information on how to use the FDA table. Click Next for more info.

< > HISTORY TRY AGAIN

Adaptive Learning - Personal Feedback

Corrective Actions

You're ahead of the game because you've already started an EMP. All three of you probably want to jump right in to save Ginger and Walter's farm, but first, you'll need to determine which corrective actions to take. What are corrective actions? Let's look at that now.



Corrective actions eliminate the source of the issue, in this case *Listeria* contamination, and make sure it's totally resolved. Corrective actions can include: cleaning, sanitizing, performing **root cause analysis** to determine the source of contamination, resampling, reworking or destroying any contaminated product (if necessary), and taking measures to prevent the same contamination from happening again.

Are you ready to jump in and start determining corrective actions?

- ☐ Yes, bring it on!
- ☐ I guess so but I'm not really sure how.
- ☒ Not really. This seems a bit complicated so far.

That's totally understandable. It's easy to feel overwhelmed by the new material and the seriousness of possible *Listeria spp.* contamination. I hope it helps to know that I'll be here to show you the way. We'll take it step-by-step until you've learned how to determine the proper corrective actions. Let's start with an example case.

Adaptive Learning - Personal Feedback

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Adaptive Learning - Choose Your Path

Choose a Case Study



Now that you're comfortable identifying corrective actions, it's time to learn what to do in the worst case scenario, a positive on a Zone 1 site.

I'm going to give you a case study to work through here in the Dairy Teaching Lab. Would you rather work on the example in the cheese room or ice cream packing area?

☐ Cheese Room

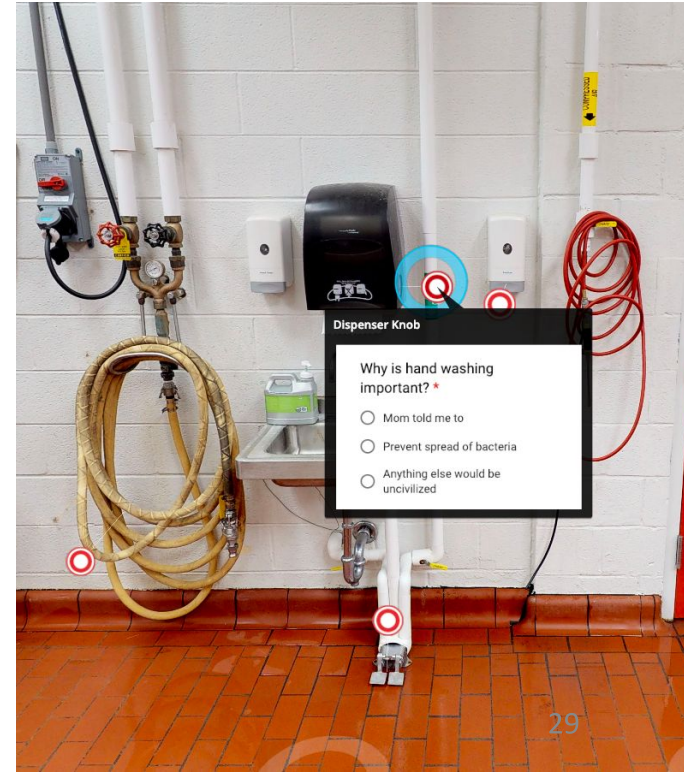


☐ Ice Cream Packaging Area

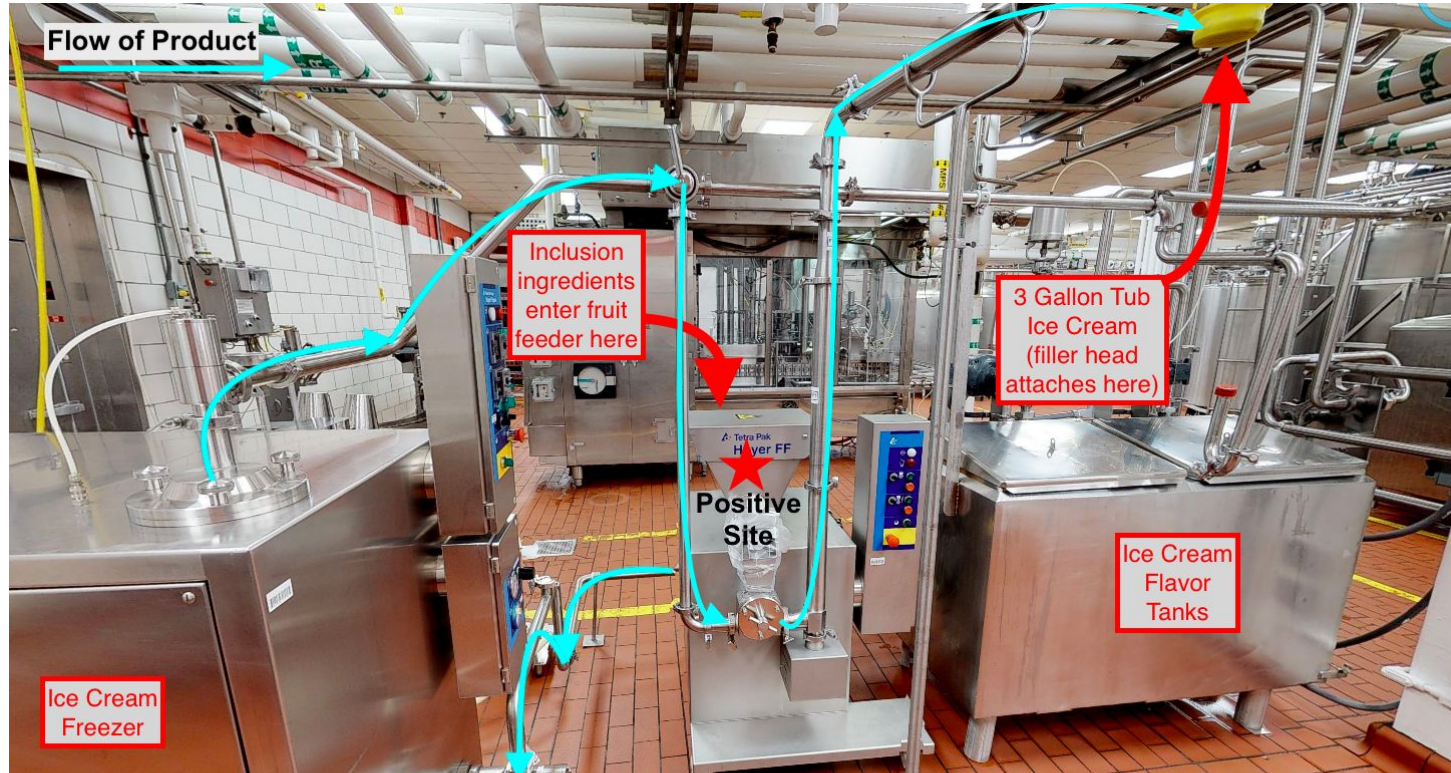


Next

Virtual Situated Learning



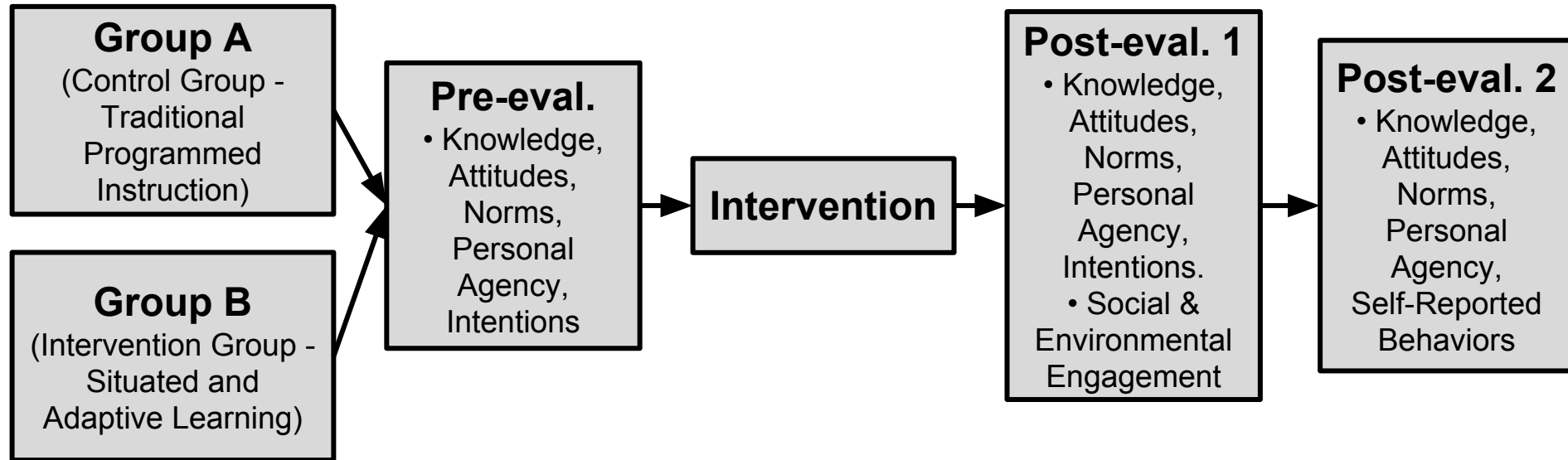
Virtual Situated Learning



Evaluation Will Identify

1. How **effective** is the online training course using situated and adaptive learning strategies, in increasing adult learners in the workplaces' **knowledge** of training topics, specifically environmental monitoring in artisan dairy facilities?
2. Were the adult learners able to **effectively apply** (behavior transfer) the training content at the dairy facility in which they work?

Experimental Design



Significance

- Serve as a model for other industries
- Make training more affordable, flexible, and adaptive
- Keep our food system safe
- Keep small businesses in business

Lessons Learned

1. Consistency within the course is difficult to maintain when multiple groups are working on different parts of the training at the same time.
2. Regulators, industry experts, and academics can have different views on the same topic - making advice difficult to give.

Resources

1. Environmental Sample Collection Image. Source: <http://www.outbreakmuseum.com/tag/salmonella-braenderup/>
2. Face-to-face Training Image. Source: <https://www.youtestme.com/employee-training-software-vs-face-face>
3. Lave, J., & Wenger, E., 1992. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge [England];New York;: Cambridge University Press.
4. Sitzmann, T., & Ely, K. (2011). A meta-analysis of self-regulated learning in work-related training and educational attainment: What we know and where we need to go. *Psychological Bulletin*, 137(3), 421–442. <https://doi-org.prox.lib.ncsu.edu/10.1037/a0022777.supp> (Supplemental)
5. Vygotskii, L. S. (1978). *Mind in society : The development of higher psychological processes*. Cambridge: Harvard University Press. Retrieved from <http://www2.lib.ncsu.edu/catalog/record/NCSU451031>

Thank You!

Questions?

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